

of the second black ring, where the tail was broken, as if given off by the only point of the ring encroached upon by the somewhat oblique fracture, and it extends to the tip. Few Iguanoids have striped tails. In fact I know but a few species, belonging to the genera *Liolaemus* and *Sceloporus*, which are so marked, and these genera happen to be among the few in the family which have the scales normally disposed quincuncially, at least in the basal part of the tail, as in the reproduced tails of nearly all Iguanoids. However, the manner in which the stripe originates in the present specimen perhaps excludes any explanation based on phylogenetic considerations. But it is a most remarkable fact how constant the type of scaling of the regenerated tail in these *Iguanidæ* is, in spite of so much diversity in the scaling of the intact organ, as shown by *Hoplurus*, *Otenosaura*, *Liolaemus*, and many others which I have been able to examine¹; whilst, on the other hand, all *Lacertidæ*, *Teiidæ*, *Zonuridæ*, and *Gerrhosauridæ* reproduce verticillate tails, whatever their normal scaling may be."

Mr. R. Gordon Wickham exhibited a remarkably fine pair of horns of the Gemsbok Antelope (*Oryx gazella*) obtained near Port Elizabeth, Cape Colony.

The following papers were read:—

1. On Pleistocene Bird-remains from the Sardinian and Corsican Islands. By R. LYDEKKER, B.A.

[Received July 30, 1891.]

(Plate XXXVII.)

During the past summer I received from my friend Prof. C. J. Forsyth Major, of Florence, a small collection of bird-bones from Pleistocene deposits in the Sardinian and Corsican islands, with the request that I would undertake their examination. The great majority of these specimens were obtained from a cave at Pietro Tampoia in the island of Tavolara, on the north-east coast of Sardinia; while others came from the ossiferous breccia of Monte San Giovanni, near the town of Iglesias, in the south-western corner of Sardinia itself. The remainder are from a breccia at Toga, near Bastia, Corsica.

The specimens forming this collection are by no means the first bird-remains which have been obtained from the Sardinian islands, since as far back as 1832 Rudolph Wagner² described and figured a considerable number of bird-bones from the ossiferous breccia of Cagliari. None of these specimens were, however, specifically

¹ I find, however, the verticillate scaling on the reproduced tails of *Uta elegans* and *U. nigricans*.

² Abh. Münch. Akad. vol. i. pp. 751-786.

determined, while in many cases even their generic position was considered doubtful; although it was suggested that they belonged¹ to the genera *Aquila*, *Buteo*, *Strix*, *Picus*, *Corvus*, *Turdus*, *Alauda*, *Fringilla*, *Sterna*, and *Anas*. Further, it appears to have been considered probable that many or all of these specimens would prove to belong to existing species. It may be added that of the generic terms mentioned above several appear to be used in their original wide Linnæan sense.

It may be observed that the majority of the Mammalian remains from the Sardinian breccias have been referred to extinct species, such as *Arvicola brecciensis* (Giebel), *A. henseli*, F. Major, *Mus orthodon*, F. Major, *Lagomys sardus* (Hensel), *Talpa tyrrhenaica*, F. Major, and *Sorex similis*, F. Major. Moreover, as the dwarf extinct Elephants and Hippopotami of Malta, Sicily, and Crete, which clearly indicate African affinities in the Pleistocene Mammalian fauna of the Mediterranean islands, may eventually be discovered in Sardinia, it is a matter of considerable interest to determine whether the Pleistocene Avian fauna of the latter exhibits a similar proportion of extinct species, and likewise shows a marked African facies.

The more migratory habits of birds as compared with mammals preclude an exact comparison between the two groups, but the presence of an African species of *Bubo*, and also of a Roller, gives a certain African facies to the Sardinian fauna. With regard to the question of extinct species, the unfortunate imperfection of our English collections of recent avian skeletons (to which I have elsewhere had occasion to allude) renders it in some cases impossible to determine definitely the species to which the specimens belong. In all cases, however, in which I have been able to make specific determinations, I have not found characters to distinguish the fossil from existing forms. Here, however, it must be borne in mind that as many species of birds seem to differ from one another only by external characters, it is possible that if we had the fossil birds before us in the flesh points of difference might be detected which are not apparent from the bare bones.

Of the remains from the Tavolara cave the most abundant are those of Shearwaters and Quails; while next to these come those of Passerines. The abundance of the bones of Shearwaters and the entire absence of those of Gulls are circumstances very difficult of explanation. The specimens from Bastia are mostly referable to Passerines, more especially *Turdidæ*, but there is one humerus of a Pigeon and the terminal phalangeal of a large Accipitrine.

I. STRIGES.

Bubo, cf. *cinerascens*, Guérin.—Among the bones from Monte San Giovanni a small species of *Bubo* is represented by the distal part of the left tarso-metatarsus, the left femur, and the imperfect left metacarpus, all probably belonging to one individual. The tarso-metatarsus, as

¹ See Gervais, Zool. et Pal. Françaises, 2nd ed. p. 423.

the most characteristic bone, is represented in figs. 1, 1*a* of the Plate. The extremity of the outer trochlea is lost, but the specimen is sufficiently well preserved to show the high arch formed by the three trochleæ, as well as the backward direction of the inner one, by which the metatarsus of the Striges is so readily distinguished from that of the Accipitres. The femur has a length of 0,065. All these bones are much smaller than those of *B. ignavus*; and as they agree precisely with those of a skeleton of the South-African *B. maculosus* in the British Museum, I am disposed to refer them to the North-African *B. cinerascens* or *B. lacteus*, the former of which was at one time identified with *B. maculosus*¹. Some terminal phalangeals of the foot from these deposits are probably referable to the same *Bubo*.

An imperfect left metacarpus from the Tavolara cave is slightly larger than the corresponding bone in the preceding series, although this difference in size may be merely sexual. It may be observed that the metacarpus of the Striges is very easily recognized by the presence of an incipient inter-metacarpal process, which attains its full development only in certain Passeres and most Gallinæ.

II. ACCIPITRES.

Milvus, cf. ictinus, Savigny.—The somewhat worn and imperfect left tarso-metatarsus represented in figs. 2, 2*a* of the Plate is from Monte San Giovanni, and presents all the characters of the Accipitres as distinct from the Striges. It is indistinguishable from the corresponding bone of a recent skeleton of *M. ictinus (regalis)* in the British Museum, to which species the specimen may well belong, although I am unable to say definitely that it should not be referred to *M. migrans (ater)* or *M. ægyptiacus*. The tarso-metatarsus of *Circus* differs from that of *Milvus* by its much greater length; while those of *Buteo* and *Pernis* are distinguished by the different direction of the hinder process of the inner trochlea.

Aquila, sp.—The terminal phalangeal of the pes of a large Accipitrine, represented in fig. 3 of the Plate, was obtained from the breccia of Monte San Giovanni, Sardinia. From its length, slenderness, and high degree of curvature, it may be safely referred to the Eagles, as distinct from the Vultures, and may have belonged to the Golden Eagle. A phalangeal of similar type from the breccia of Toga, Corsica, may not improbably pertain to the same species.

Vultur, cf. monachus, Linn.—The imperfect hinder part of the cranium of a large Accipitrine from the breccia of Monte San Giovanni indicates a Vulture which appears inseparable from the existing *Vultur monachus*. As this specimen is not calculated to give a good figure, I have not had it drawn. This skull is distinguished from the largest species of *Aquila* not only by its superior dimensions, but also by its more depressed contour and the form of the temporal fossa. The narrow and highly vaulted skull of *Gyps* is even still more unlike the fossil. Compared, however, with a recent skull of

¹ See Blanford, 'Zoology of Abyssinia,' pp. 302, 303.

Vultur monachus in the British Museum, the Sardinian skull presents such a close resemblance that there can be little doubt that it belongs either to that species or to a closely allied form. I have already recorded¹ remains of *Vultur monachus* from the cavern of Bruniquel, in the Tarn-et-Garonne, France.

III. PICARIÆ.

Coracias, cf. abyssinica, Bodd.—The only Picarian remains in the collection comprise a few bones, apparently belonging to a single individual, from the Tavolara cave. These include the right coracoid, and the left femur, tibio-tarsus, and tarso-metatarsus. The two latter are represented in figs. 4, 4a of the Plate, while the coracoid is figured in woodcut 1.

The bones of Picariæ may readily be distinguished from those of Passeres (with which alone the smaller forms are at all likely to be confounded) by many features. Thus the humerus differs by the absence of the median tubercle on the distal part of the palmar aspect above the condyles. Again, the tibio-tarsus, as a general rule, is characterized by the very slight development of the crests at the proximal extremity, and has a very prominent tubercle on the anterior surface of the distal part of the shaft, some distance above the condyles. Moreover, the fibular ridge is very short and often low; while the distal condyles have a contour very different from that obtaining in the Passeres. The tarso-metatarsus is generally relatively shorter than in the latter, with a great distal expansion, and a distinct prominence on the inner border above the articular surface for the hallux; while the upper part of its anterior surface generally has a deep depression, with two foramina, dividing the three primary elements of the metatarsus. The distal trochleæ, which are wider than in the Passeres, are generally situated in the same vertical plane, and may or may not descend to the same horizontal line.

Such characters are presented by the bones before us. The tarso-metatarsus is characterized by its relative length and slenderness, by the presence of only a single closed tube in the talon (hypotarsus), and also by the circumstance that the three distal trochleæ descend nearly to the same level. In the latter respect it differs from the tarso-metatarsus of the Cuckoos and their allies, but agrees, as in the other points, with that of the Kingfishers, Bee-eaters, and Rollers. The tarso-metatarsus of the Kingfishers is distinguished by its shorter and stouter form, and also by the relatively higher position of the foramen between the third and fourth trochleæ; while that of the Bee-eaters is sufficiently distinguished by its smaller dimensions.

Compared with the corresponding bones of the Blue Roller (*Coracias garrula*), the tibio-tarsus and tarso-metatarsus agree so closely in structure in every respect that there can be no doubt that they indicate a bird of the same genus. There is, however, some discrepancy in size, as shown by the following measurements:—

¹ Cat. Foss. Birds Brit. Mus. p. 32 (1891).

	<i>C. garrula.</i>	Fossil.
Length of tibio-tarsus	0,044	0,043
„ of tarso-metatarsus ..	0,024	0,0225

These show that not only are the fossil bones rather smaller than those of *C. garrula*, but that in the former the tarso-metatarsus is shorter in proportion to the tibio-tarsus than in the latter. It appears that the two sexes of the Blue Roller do not differ in size, and it is therefore pretty evident that the fossil bones do not belong to that species. They may, however, be referable to the Abyssinian Roller (*C. abyssinica*), of which I have been unable to see a skeleton. That bird, of which only one specimen appears to have been recorded in Europe, is common in parts of Abyssinia and likewise occurs in Arabia. The fossils may, however, equally well have belonged to the N. African *C. pilosa*. The woodcut represents the coracoid of the Sardinian Roller.

Fig. 1.



Ventral aspect of right coracoid of *Coracias*, cf. *abyssinica*; from Tavolara. †.

IV. PASSERES.

Corvus corone, Linn.—Evidence of the presence of the Crow in the Sardinian Pleistocene fauna is afforded by the coracoid from Tavolara represented in fig. 5 of the Plate. This specimen, which belongs to the right side, accords in every respect with the corresponding bone of recent skeletons.

Fringillidæ.—Several species of *Fringillidæ* are indicated by humeri and other bones, but from their small size, and the large number of the existing species of these birds, the specific, and in some cases even the generic, determination is difficult. It may be observed that the humerus of this family is easily recognized by the great development of its tricipital fossa, which is separated from the subtrochanteric fossa merely by a thin septum of bone in its upper half, the lower portion of the two fossæ being confluent. In this respect the *Fringillidæ* differ widely from the *Corvidæ* (near to which they are usually placed), in which the tricipital fossa of the humerus is scarcely developed at all.

Of the specimens which can be more or less definitely recognized,

we may first mention the right humerus from Tavolara represented in figs. 7, 7 *a* of the Plate. This agrees in all respects with the corresponding bone of a recent Hawfinch (*Coccothraustes vulgaris*), and may be confidently referred to that widely-spread European species. A right tibio-tarsus from the same locality is probably also referable to this bird. Three smaller humeri, from Monte San Giovanni, appear to be referable to the Bullfinch (*Pyrrhula europæa*), which now occurs in many parts of Italy, occasionally reaching as far south as Sicily. Three other humeri, of a more slender type, come very close to those of the Chaffinch (*Fringilla cælebs*), although slightly larger than in existing examples; these bones are from Tavolara. Two considerably smaller humeri of a Finch from the same locality may prove to belong to the Serin (*Serinus hortulanus*), now so common in Italy.

Alaudidæ.—The humerus of the Larks is readily distinguished from that of the Finches by the very slight development of the tricipital fossa, which forms a mere shallow depression quite distinct from the subtrochanteric fossa. Such a type of humerus is presented by the specimen of the right side from Monte San Giovanni represented in figs. 9, 9 *a* of the Plate. Since this bone is somewhat smaller than the humerus of *Alauda arvensis*, I think it not improbable that it may belong to *A. arborea*. A humerus from a breccia at Montmorency figured by A. Milne-Edwards, 'Rech. Oiseaux Foss. de la France,' pl. 156. figs. 22, 23, and referred to *A. cristata*, is of the size of that of *A. arvensis*, its characters being exactly those of the present example.

Sylviidæ.—Some small humeri in the collection not improbably indicate members of this family, although I have been unable to determine them even generically.

Turdidæ.—In this family the humerus is intermediate in character between that of the *Fringillidæ* and that of the *Alaudidæ*, having well-developed tricipital and subtrochanteric fossæ, separated from one another by a complete bony septum. These characters are shown in the right humerus from the breccia of Monte San Giovanni represented in figs. 8, 8 *a* of the Plate. This specimen has a length of 0,0265, and is rather larger than the corresponding bone of *Monticola cyanus* figured in Milne-Edwards's 'Rech. Oiseaux Foss. de la France,' pl. 149. fig. 16. The left tibio-tarsal and tarso-metatarsus from Tavolara, represented in figs. 6, 6 *a* of the Plate, may belong to the same kind of Thrush. The humerus differs from that of *Monticola cyanus* not only by its larger size but by the lesser development of the delto-pectoral crest. In the form of the latter, as well as in absolute size, it agrees so closely with the corresponding bone of *Turdus musicus* that it may be at least provisionally referred to that species.

A larger representative of the *Turdidæ* is represented by nine humeri and four other bones from the breccia of Toga, Corsica. The number of the humeri appears to indicate a gregarious species. One of these humeri, of the right side, is represented in woodcut 2, and has a length of 0,0295. Unfortunately I have had no opportunity of comparing this specimen with a humerus of *Turdus merula*. It is,

however, rather smaller than one of *T. torquatus* belonging to a skeleton in the British Museum. Moreover, it agrees with that specimen in the slight degree of development of the oblique ridge on the outer surface of the delto-pectoral crest, in which respect it differs from the humerus of *Turdus* proper. I am therefore inclined to refer the

Fig. 2.



Dorsal and palmar aspects of the right humerus of *Turdus*, cf. *merula*, from Toga, Corsica. $\frac{1}{2}$.

specimen to the Meruline group, and think it highly probable that it belongs to *Turdus merula*.

Hirundinidæ.—The humerus of the Swallows is characterized by its relative shortness, and the development of a narrow and very shallow tricipital fossa extending slightly beneath the head. The specimen of the left side, from Monte San Giovanni, represented in figs. 10, 10 *a* of the Plate, indicates a member of this family, and is not improbably referable to *Hirundo rustica*. It is slightly narrower than the recent humerus of *Cheledon urbica* figured by Milne-Edwards in his 'Rech. Oiseaux Foss. de la France,' pl. 149. fig. 4, and still narrower than the fossil one of *Cotile rupestris* represented in plate 156. fig. 24 of the same work.

V. COLUMBÆ.

Columba, cf. *livia*, Linn.—The only specimen in the Sardinian collection which can be referred to the *Columbidæ* is the coracoid from Tavolara represented in fig. 11 of the Plate. This specimen has lost the subclavicular process as well as the extremity of the hyosternal angle. It agrees so closely with the coracoid of *Columba livia* that I am disposed to refer it to that species, now common on both sides of the Mediterranean.

Among the specimens from the breccia of Toga, Corsica, is the right humerus of a Pigeon which may probably be referred to the same species as the Sardinian coracoid. The length of the specimen (fig. 3, p. 474) is 0,044; and it agrees very closely with the corresponding bone of a rather larger skeleton of *C. livia* in the British Museum.

VI. GALLINÆ.

Coturnix communis, Bonnaterre.—As might have been expected from the abundance of the species at the present day on the Italian coasts, the remains of Quail are extremely common in Tavolara. The only specimen that I have thought it necessary to figure is the right tarso-metatarsus (represented in fig. 12 of Plate XXXVII.); but the collection comprises many specimens of this bone, as well as some of the tibio-tarsus, femur, coracoid, furcula, humerus, &c. Remains of Quail have been recorded by Milne-Edwards (*t. c.* pl. 134. figs. 25, 56) from the ossiferous breccia of Montmorency (Seine-et-Oise).

Fig. 3.



Palmar aspect of the right humerus of *Columba*, cf. *livia*, from the breccia of Toga, Corsica. $\frac{1}{4}$.

VII. TUBINARES.

Procellaria.—Perhaps no bird-bones are more easily recognized than those of the *Procellariidæ*; some of the most characteristic being the coracoid, the humerus, and the tibio-tarsus. The humerus is readily distinguished from that of the Gulls by the absence of any distinct tricipital fossa, while the tibio-tarsus is equally well characterized by the upward prolongation of its cnemial crest. Again, the wing-phalangeals lack the two fenestræ which are so especially distinctive of that bone in the *Gaviæ*.

The collection from the Tavolara caves comprises, as I have said, a large number of bones of *Puffinus* clearly referable to three distinct species. The want of skeletons of all the recent species of the genus, to which I have already alluded, precludes, however, the specific determination of more than two of these forms.

These three Shearwaters are represented by bones from nearly all parts of the skeleton, including the skull. The specimens of the skull are alone sufficient to indicate the presence of three species, and are important in showing that all three belong to the long-beaked genus *Puffinus* as distinct from the shorter-beaked *Fulmarus*. The bones selected as illustrations of the three species are, however, chiefly the humerus, tibio-tarsus, and tarso-metatarsus.

The largest species of *Puffinus* is indicated by the right humerus, represented in figs. 13, 13 *a* of Plate XXXVII., which has a total length of 0,115. The proximal end of another right humerus indicates a slightly larger bird; and there are likewise a perfect radius and ulna according in size with the humeri, while there are also examples of the metacarpus. The skull is indicated by the imperfect rostrum, and the hinder part of the left mandibular ramus. The other bones from Tavolara which I refer to this species include the right coracoid and two examples of the femur. There is also a femur probably referable to this species from Monte San Giovanni.

The figured humerus is slightly longer than the one of *P. cinereus*, Stephens, figured by Milne-Edwards in his 'Rech. Oiseaux de la France,' pl. 52. fig. 7; and since it agrees very closely with the corresponding bone of a skeleton of *P. fuliginosus*, I am inclined to refer it to that species, which now inhabits South Europe. The tibio-tarsus of that species has a comparatively short cnemial crest, like that of the specimen represented in fig. 14 of the Plate.

The second species of the genus is represented by the right tibio-tarsus and tarso-metatarsus, drawn in figs. 14, 14 *a* of Plate XXXVII., as well as by the rostrum and portions of the mandible, together probably with some bones not easy to distinguish from those of the third species. The tibio-tarsus is very considerably larger than that of *P. obscurus* (Milne-Edwards, *op. cit.* pl. 51. figs. 14, 15), so that these specimens could not possibly have belonged to the still larger *P. fuliginosus*. In the small relative height of the cnemial crest this type accords with *P. fuliginosus*, and also with that of *P. chlororhynchus*, Less., of Madagascar, &c., the latter being, however, considerably smaller than the specimen before us. The figured tarso-metatarsus accords fairly well in relative size with the tibio-tarsus (although there are some slightly smaller specimens of the opposite side agreeing still better in this respect), and calls for no special mention. The species to which these bones belonged may probably be regarded as one allied to *P. chlororhynchus*.

The third species of *Puffinus*, as typified by the tibio-tarsus and tarso-metatarsus represented in figs 16, 16 *a* of Plate XXXVII., is distinguished from the preceding not only by its inferior size, but also by the much greater length of the cnemial crest of the tibio-tarsus. To the same species may be referred the type of humerus represented in figs. 15, 15 *a* of the Plate, as well as a coracoid and several examples of the radius, ulna, and metacarpus. There are likewise several more or less imperfect specimens of the cranium and mandible belonging to this species.

The tibio-tarsus accords in all respects with the corresponding bone of a skeleton of *P. anglorum* preserved in the Prosector's room at the Society's Gardens; and I should have no hesitation in referring the fossil form to that species were there not some doubt whether the Mediterranean representative of this Shearwater does not form a distinct species (*P. yelkouan*, Acerbi¹). There can, however, I think be no doubt but that the fossil belongs to one or other of these two forms.

¹ See Yarrell's 'British Birds,' ed. 4, vol. iv. pp. 25, 26.

I may observe that *P. tenuirostris*, Temm., of Japan &c., agrees with *P. anglorum* in the great length of the cnemial crest of the tibio-tarsus, and that *P. cinereus*¹ makes an approximation in this respect. In *P. fuliginosus* and *P. chlororhynchus*, however (as I have observed), the cnemial crest of the tibio-tarsus is of the short type of the specimen represented in fig. 14 of the Plate; and I would suggest that attention to the relative length of this crest may afford important aid in the specific determination of the Shearwaters.

DESCRIPTION OF PLATE XXXVII.

- Figs. 1, 1 a. *Bubo*, cf. *cinerascens*, Guérin. Anterior and distal aspects of the distal half of the left tarso-metatarsus.
 2, 2 a. *Milvus*, cf. *ictinus*, Savigny. Anterior and distal aspects of the left tarso-metatarsus.
 3. *Aquila*, sp. Terminal phalangeal of the pes.
 4, 4 a. *Coracias*, cf. *abyssinica*, Bodd. Anterior aspect of the left tibio-tarsus and tarso-metatarsus.
 5. *Corvus corone*, Linn. Ventral aspect of the right coracoid.
 6, 6 a. *Turdus musicus*, Linn. Anterior aspect of the left tibio-tarsus and tarso-metatarsus.
 7, 7 a. *Coccothraustes vulgaris*, Pallas. Palmar and dorsal aspects of the right humerus.
 8, 8 a. *Turdus*, cf. *musicus*, Linn. Palmar and dorsal aspects of the right humerus.
 9, 9 a. *Alauda*, cf. *arborea*, Linn. Palmar and dorsal aspects of the right humerus.
 10, 10 a. *Hirundo* (?) sp. Palmar and dorsal aspects of the left humerus.
 11. *Columba*, cf. *livia*, Linn. Ventral aspect of the left coracoid.
 12. *Coturnix communis*, Bonnaterre. Anterior aspect of the right tarso-metatarsus.
 13, 13 a. *Puffinus fuliginosus*, Kuhl. Palmar and dorsal aspects of the right humerus.
 14, 14 a. *Puffinus*, sp. 2. Anterior aspect of the right tibio-tarsus and tarso-metatarsus.
 15, 15 a. *Puffinus*, cf. *anglorum*, Temminck. Palmar and dorsal aspects of the left humerus.
 16, 16 a. *Puffinus*, cf. *anglorum*. Anterior aspect of the right tibio-tarsus and tarso-metatarsus.

All the specimens are represented of the natural size. Those in figures 1, 2, 3, 8, 9, and 10 are from the ossiferous breccia of Monte San Giovanni, near Iglesias, Sardinia; the others from a cave at Pietro Tampoia, Tavolara.

2. On Remains of a Large Stork from the Allier Miocene.

By R. LYDEKKER, B.A.

[Received July 30, 1891.]

In his well-known work on the Fossil Birds of France, Prof. A. Milne-Edwards² described the remains of a Stork from the Lower

¹ See Milne-Edwards, *op. cit.* pl. 51. figs. 14, 15.

² Rech. Oiseaux Foss. de la France, vol. i. p. 460 (1867-68).